10/570903
IAP20 Rec'd PCT/PTO 07 MAR 2006

CLAIMS

1. A fuel cell separator comprising a resin conductive layer as a mixture of a resin and a conductive filler at least on one side of a metal substrate, wherein

the resin conductive layer comprises

(a) a first resin layer having a volume resistance of 1.0 Ω·cm or less, and

(b) at least one of a second resin layer constituting the surface of the resin conductive layer and having a volume resistance smaller than that of the first resin layer and a third resin layer formed in an interface with the metal substrate and having a volume resistance smaller than that of the first resin layer.

2. The fuel cell separator as claimed in Claim 1, wherein each of the second resin layer and the third resin layer has a larger volume content of the conductive filler in the respective resin layer than that of the conductive filler in the first resin layer.

3. The fuel cell separator as claimed in Claim 1, wherein each of the second resin layer and the third resin layer has a volume resistance of 0.5 Ω·cm or less.

4. The fuel cell separator as claimed in Claim 1, wherein the first resin layer contains the conductive filler in 5 to 40 % by volume and each of the second and the third resin layers contains the conductive filler in 20 to 90 % by volume.

5. The fuel cell separator as claimed in Claim 4, wherein the first resin layer contains the conductive filler in 8 to 15 % by volume.

6. The fuel cell separator as claimed in Claim 1, wherein the metal substrate is made of a material selected from the group consisting of stainless steel, titanium, aluminum, copper, nickel and steel.

7. The fuel cell separator as claimed in Claim 6, wherein the metal substrate has, in its surface, a plated layer made of at least one metal selected from the group consisting of nickel, tin, copper, titanium, gold, platinum, silver and palladium.

8. The fuel cell separator as claimed in Claim 6, wherein the metal substrate has a roughened surface.

9. The fuel cell separator as claimed in Claim 1, wherein the conductive filler is selected from the group consisting of carbon materials, metal carbides, metal oxides, metal nitrides and metals.

10. The fuel cell separator as claimed in Claim 9, wherein the conductive filler is selected from the group consisting of carbon black and a fine carbon fiber.

11. The fuel cell separator as claimed in Claim 1, wherein the conductive filler contained in each of the second resin layer and the third resin

layer comprises the fine carbon fiber.

12. The fuel cell separator as claimed in Claim 11, wherein the fine carbon fiber has a fiber diameter of 0.001 to 0.5 μm and a fiber length of 1 to 100 μm.

13. The fuel cell separator as claimed in Claim 9, wherein the conductive filler contained in the first resin layer comprises carbon black.

14. The fuel cell separator as claimed in Claim 1, wherein the resin is selected from the group consisting of fluororesins, fluororubbers, polyolefin resins and polyolefin elastomers.

15. The fuel cell separator as claimed in Claim 1, wherein the first resin layer has a thickness of 5 to 300 μm, and each of the second and the third resin layers has a thickness of 0.1 to 20 μm.

16. The fuel cell separator as claimed in Claim 1, wherein the resin conductive layer has the first and the second resin layers.

17. The fuel cell separator as claimed in Claim 1, wherein the resin conductive layer has the first and the third resin layers.

18. The fuel cell separator as claimed in Claim 1, wherein the resin conductive layer has the first, the second and the third resin layers.

19. A process for manufacturing the fuel cell separator as described in Claim 1, comprising steps of:

laminating a resin conductive layer as a mixture of a resin and a conductive filler on at least one side of a metal substrate; and

forming a protrusion and a trench to be a gas channel, by pressing the substrate having the laminated resin conductive layer.

20. The process for manufacturing a fuel cell separator as claimed in Claim 19, further comprising a step of thermal annealing after the forming the protrusion and the trench by pressing.

21. A process for manufacturing a fuel cell separator as described in Claim 1, comprising steps of:

laminating a resin conductive layer as a mixture of a resin and a conductive filler on at least one side of a metal substrate;

covering the uppermost surface of the metal substrate having the laminated resin conductive layer with a protective film;

forming a protrusion and a trench to be a gas channel by pressing the substrate covered by the protective film; and

peeling the protective film from the substrate having the protrusion and the trench.

22. The process for manufacturing a fuel cell separator as claimed in Claim 21, further comprising a step of thermal annealing after forming the protrusion and the trench by pressing.

23. The process for manufacturing a fuel cell separator as claimed in Claim 22, wherein the thermal annealing is conducted after peeling the protective film from the substrate having the protrusion and the trench.

24. The process for manufacturing a fuel cell separator as claimed in Claim 21, wherein a tensile fracture elongation of the protective film is 150 % or more in both longitudinal and transverse directions.

25. The process for manufacturing a fuel cell separator as claimed in Claim 21, wherein the protective film has a thickness of 5 to 100 μm.